

University of New Hampshire Combined Research and Extension Plan of Work 2020-2024

Status: Final
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I. Plan Overview

1. Executive Summary

New Hampshire has 1.38 million people, including 6.5 percent people belonging to minority groups. (<http://worldpopulationreview.com/states/new-hampshire-population/> 5/2019). Agriculture and associated natural resources are core contributors to the economy in a state that is 81 percent forested (<https://www.nhdf.org/reports/forest-statistics-2012>). While most of New Hampshire is rural in character, the southern tier is home to several small cities (30,000-111,000 people). The attractive, open spaces maintained by predominantly pastoral, small-scale agricultural operations combine with the state's abundant natural resources support a large tourism sector.

The University of New Hampshire (UNH) in Durham is the state's flagship, public, land-grant university, conducting instruction, research, and outreach to people beyond the formal classroom. The New Hampshire Agricultural Experiment Station (NHAES) resides within the UNH College of Life Sciences and Agriculture (COLSA). NHAES is responsible for the funding of Hatch and Hatch-Multistate agricultural research and McIntire-Stennis cooperative forestry research programs. The Executive Summary of the Institutional Profile describes aspects of the NHAES's federal and state partnership-funded Hatch and Hatch-Multistate research components.

NHAES focuses on research challenges that have local, national, and international relevance. NHAES is closely mindful of the Hatch Act directive, which asserts that experiment stations are best able to prioritize specific research needs for their respective states. The diverse funding portfolio of our researchers demonstrates the success of NHAES foundational support and investments, leading to strong productivity and the ability of scientists to further leverage their research findings into federal grants activity. This results in strong added value for New Hampshire taxpayers. Hatch capacity funds provide a critical baseline capability to support agricultural and natural resources programming, as well as providing opportunities for training the next generation of agricultural scientists and citizen-consumers. Located in close proximity to the Gulf of Maine, UNH also provides an opportunity to support a small but growing industry of coastal marine aquaculture through research and meaningful engagement with producers, harvesters, and other stakeholders.

Research at the farms and dairies address both conventional and organic research, and management needs, which are disseminated to our varied stakeholders. NHAES funds the Woodman Horticultural Research Farm, Kingman Research Farm (agronomy), Organic Dairy Research Farm (ODRF), Macfarlane Research Greenhouses, Fairchild Dairy Teaching and Research Center (a conventional dairy), and other properties within a six-mile radius of Durham. These facilities are available to both NHAES researchers and Extension Specialists. As part of our research commitment, the greenhouses are undergoing renovation and modest expansion over the next six months.

UNH Cooperative Extension (UNHCE) is the primary outreach department of the University of New Hampshire. The organization's mission is to strengthen people and communities by providing trusted knowledge, practical education and cooperative solutions in Food and Agriculture; Natural Resources; Community and Economic Development; and Youth and Family. Specialists based on the Durham, NH Campus and in county Extension offices design and deliver research-based educational programming to people throughout the state. 5,481 volunteers of Extension's fourteen volunteer programs extend the reach of Extension specialists and staff. In 2018, volunteers contributed 206,317 hours of service on behalf of UNH Cooperative Extension.

UNHCE's strategic plan (2016-2021) has three priorities for the organization. Examples of programs initiated since the implementation of the strategic plan follow each priority.

Extension's strategic plan (2016-2021) has three priorities:

Meet people where they are with relevant, high-quality programming.

Examples of Initiatives:

Formation of a task force on cultural proficiency and training for staff in fair and inclusive hiring practices, implicit bias and the value of diversity in the workplace.

New system for collecting and reporting demographic data on race, ethnicity, gender, age, and geographic location.

Bring people together to find practical solutions to the issues they care about.

Examples of Initiatives:

BioBlitz – Scientists and trained volunteers collect data on wildlife species on a given property in a short amount of time. This project increases community engagement and informs towns for stewardship planning.

Schoolyard SITES –Volunteers and elementary school teachers partner to improve educators' self-efficacy, science content knowledge and instructional practice.

Cultivate a team of innovative, energized, and connected staff and volunteers.

Examples of Initiatives:

Formation of a staff professional development committee.

Diversification of state and county advisory councils.

The Status of Agriculture and Natural Resources in New Hampshire

Many New Hampshire farms are small and diversified. Beekeepers raise bees for honey and to provide crop pollination. "Pick Your Own" berry and fruit operations are widespread. Specialty livestock, including goats, rabbits, sheep, and other animals, are grown for wool and fiber. Larger commodities include Christmas trees, apples, and livestock (forage crops, beef, sheep, swine, poultry, and dairy) raised for home, local restaurants, and commercial sales. Agricultural diversity is growing to encompass the commodity mix of both Northern and Southern New England. (NASS 2014; NH Weekly Market Bulletin February 25, 2015).

Greenhouses and nurseries producing annuals, perennials, shrubbery, and trees for landscaping is another productive sector of the state's economy (\$32M/annually). Well-established firms (Cole Greenhouses and Pleasant View Gardens) are expanding into year-round herb and aquaponic lettuce production (<http://www.lef-farms.com/>). There are plans for a large aquaponics greenhouse for produce production, powered by biomass heat in the economically depressed Northern tier of the state (<https://www.nhpr.org/post/waste-heat-berlin-biomass-plant-will-help-grow-hydroponic-greens#stream>).

New Hampshire highlights of the initial results from the 2017 USDA Agricultural Census

(<https://www.nass.usda.gov/Publications/AgCensus/2017>) show consolidation: a 6 percent decrease in farms since 2012 (https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/New_Hampshire/cp99033.p)

df). New Hampshire has 31 percent beginning producers, compared with the national average of 27 percent. Farms have a small number of minority producers at 1.3 percent. NH Farms have 85% internet access overall compared with 75 percent average across the country (ibid.). Farms produced 90 percent more gallons of maple syrup than in 2012, while Christmas tree sales decreased by 20 percent. Organic operations have decreased by 25 percent, and income from organic farming has decreased by 34 percent.

(https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/42/state/NH), Notably, the research activities in NHAES and dissemination by UNHCE have been successful in promoting adoption of more sustainable land use practices in New Hampshire with a 66% increase in cover crops and 147% increase in no-till practices (<https://www.colsa.unh.edu/nhaes/article/2019/05/sustainableag>).

Maintaining and growing agricultural land in New Hampshire is a significant challenge given the high land costs and taxes. Many farms are small or part-time ventures: approximately 70 percent of farms produce less than \$10,000 in yearly sales (NH Weekly Market Bulletin February 25, 2015). New and beginning farmers are younger with smaller-scale operations. Immigrants from Africa (Democratic Republic of Congo, Sudan, and Somalia) and Asia (Bhutan, and Burma) are increasingly taking jobs in farm labor (www.dhhs.nh.gov 10/27/2014).

The farm-to-table movement is particularly strong in New England. The proximity of agricultural operations to U.S. population centers represents a unique facet of the Northeast region and a distinctive feature relative to education, research, and extension within other regions. In 2012 New Hampshire ranked second in the nation with farms that have direct sales to consumers (31 percent). (USDA National Agricultural Statistics, 2012 Census of Agriculture). Summer and fall farmers markets (more than 52), and farm stands (more than 70) are widespread (<http://agriculture.nh.gov/publications-forms>; accessed 3/7/2016). Winter farmers markets have become highly successful; there are 23 at the latest count and there is increasing participation in Community Support Agriculture (CSA) farms and Community Supported Fisheries (CSF). New initiatives in developing Food Hubs will enhance the ability of producers to reach local and regional markets. Recently completed surveys from NE1749 results indicate that even in relatively similar and geographically proximate states, demand functions may differ considerably (Werner, et al. "Prospects for New England Agriculture: Farm to Fork." Presented at the 2018 Northeastern Agricultural and Resource Economics Association Pre-Conference Workshop "Advances in the Economic Analysis of Food System Drivers and Effects." June 9-10. Philadelphia, PA.)

Both UNHCE and NHAES collaborate with the Northeast Regional Climate Hub in Durham, NH, under the direction of David Hollinger with the USDA Forest Service. The hub provides a network for information sharing that address important regional and local farming and forestry challenges. NHAES also collaborates with UNH's Institute for Earth Ocean and Space (EOS), an internationally known for research on climate change and its impact. NHAES has an extensive research portfolio in agriculture, natural resources and forestry research related to climate change's driving factors and impacts, and the adaptations needed to limit its effects. UNHCE works with communities to plan for changing climate and its impacts.

CRITICAL ISSUES

The NHAES and UNHCE have selected six critical issues that encompass both units' activities: rural community and economic development economy; agriculture; food safety, climate change and sustaining natural resources; obesity and health. In addition, UNHCE has responsibilities for education and outreach that supports programming for the critical issue of youth and family.

Critical Issue One: RURAL COMMUNITY AND ECONOMIC DEVELOPMENT

NHAES

The NH rural economy encompasses tourism, farming, and forestry. FFY20 research activities include demographic analysis of population and economic trends for policymakers. Improving the prosperity of rural communities by identifying opportunities for local food sales to urban populations. Applying agroecology and economic modeling to intercropping of domesticated apples and heirloom cider varieties, to decrease insecticide inputs. Enhancing local vegetable and fruit production by trialing new cultivation practices, season extension, and identifying plant varieties that are appropriate to NH's short humid growing season, cold winter temperatures, soil types, and prevalent pests. Dissemination of

recommendations to stakeholders occurs through collaboration with UNHCE.

Professor John Halstead's work on enhancing rural economic opportunities, community resilience, and entrepreneurship to identify opportunities for local food sales to urban populations and evaluating the economic feasibility of recycling paper for animal bedding (NE1749).

Demographic analyses by Professor Ken Johnson of population and economic trends for policymakers including rural migration and natural increase(W4001).

Assistant Professor Shadi Atallah's research on applying agroecology and economic modeling to intercropping of domesticated apples and heirloom cider varieties to decrease insecticide inputs (NE1501).

Professor and Extension Specialist Becky Sideman's new Hatch Project to enhance local vegetable and fruit production by trialing new cultivation practices, season extension, and identification of plant varieties that are appropriate to NH's short, humid growing season, cold winter temperatures, soil types, and prevalent pests.

UNHCE

Community and Economic Development specialists seek to cultivate civic leaders; foster participation in community decision-making and build the capacity of communities to grow the local and regional economy. To achieve the mission, staff provide civic leaders with training, educational resources, and technical assistance in community engagement, economic development, leadership development, and community-based natural resources stewardship.

Downtowns and Trails program is focused on training community members to leverage their town's natural resource base to create vibrant economies and enhance quality of life for all.

Community and Economic Development programs seek and build local leadership to look at local assets, create a vision for the future, and identify strategies to strengthen communities. Example programs include Business Engagement and Retention, Economic Profiles, Economic Development 101, Economic Development Academy, First Impressions, Community Profiles, Main Street Academy, and Community Engagement Academy.

Community and Economic Development specialists provide technical assistance and custom training to community groups as requested. Topics include civil discourse, group facilitation and working with diverse audiences.

Critical Issue Two: AGRICULTURE

NHAES

Research includes marker-assisted breeding of kiwiberry and strawberry. Hybrid squash rootstocks that enhance grafted melon growth during the short NE summer. New tools from genome sequencing to distinguish barberry species and speed breeding. Crop health targets include soil microbiomes, biomarkers for parasitic nematodes, and disrupting leafhopper communication to control infestations. Aquaculture research targets smelt and striped bass, identifying sensory control of larval settling of fouling organisms, lumpfish to control sea lice predation, and refining recirculating aquaponics for the balanced production of fish and plants. Dairy research activities include oogenesis and zygote implantation and evidence-based recommendations for using brewers grain for heifer growth.

Marker-assisted breeding of kiwiberry and strawberry.

Hybrid squash rootstocks that enhance grafted melon growth during the short New England summer.

Continued breeding of winter squash for disease resistance, and improved nutritional profiles.

New tools from genome sequencing to distinguish barberry species and speed breeding including for wheat rust resistance.

A new long-term foundational project will target development of new, resilient crop options for regional growers in New England.

Crop health targets include soil microbiomes, biomarkers for parasitic nematodes, and disrupting leafhopper

communication to control infestations.

Aquaculture research targets smelt and striped bass production, identifying sensory control of larval settling of fouling organisms; using lumpfish to control sea lice predation; and refining recirculating aquaponics for balanced production of fish and plants.

Dairy research activities include fundamental research on dairy cow oogenesis and zygote implantation and an applied project to produce evidence-based recommendations for using brewer grain to enhance heifer growth.

UNHCE's Food and Agriculture specialists deliver education and technical assistance to residents of New Hampshire, the state's agricultural and horticultural industries, and the state's food system. Specialists are trusted partners, providing current, research-based educational programming to farmers, gardeners, and businesses. UNHCE enables individuals to make informed decisions in the pursuit of sustainable and productive local agriculture.

Fruit and Vegetable programs focus on Integrated Pest Management, crop production techniques for northern climate, season extension, variety selection, training and management of fruit crops, nutrient management and soil health.

Dairy, Livestock and Forage Crops programs include pasture management, rotational grazing, forage crop management, dairy economics, small-scale livestock production and cover cropping.

Agricultural Business Management to help improve profitability and improve quality of life for agricultural producers.

Programs include farm and estate planning, managing risk on the farm, marketing agricultural products, business planning, and rules and regulation.

Landscape and Greenhouse Horticulture programs to help our communities to adopt better landscape design and maintenance practices enhance ecosystem services, which benefit the environment. Programs include greenhouse production and economics, nursery production research and a network for environment and weather applications in New Hampshire.

Pesticide Safety Education Program trains licensed pesticide applicators and those seeking a pesticide license on the safe and effective use of agricultural chemicals used for pest management.

The Education Center and Info Line is staffed by Extension professionals and trained volunteers. A toll-free hotline is available for questions from the public on topics related to gardening, yard and home maintenance, garden and structural pest management, nuisance wildlife, food preservation and safety and seasonal issues. Between 4,000 and 5,000 calls, emails or drop-ins are serviced each year. In addition, staff and volunteers write weekly garden columns for newsletters, newspapers and social media.

Critical issue three: FOOD SAFETY

UNHCE

The CDC estimates that each year about 1 out of 6 Americans or 47.8 million people get sick from foodborne illness. About 128,000 of them are hospitalized and 3,037 die. According to the 2010 publication of Georgetown University, the annual cost of foodborne illnesses is \$152 billion. For NH, the estimated annual cost of foodborne illness was \$681 million with a per case cost estimate of \$1,892. NH restaurants are projected to record \$2.3 billion in sales between 2012 and 2022. However, more than 63,800 people and many employees have no or limited training in food safety. The UNHCE Food Safety program addresses these needs with food safety education targeting each sector of the food system, including production, foodservice, and consumers, with research-based educational programs, resources, and information.

Food Safety programs address food safety issues with educational activities targeting each sector of the food system, including production, foodservice, and consumers, with research-based educational programs, resources, and information. Food Safety Modernization Act programming includes Preventative Controls for Human Food and the Produce Safety Rule.

NHAES food safety priorities: Researchers will focus on two food safety problems: 1) improved surveillance for and

forecasting of outbreaks of shellfish contamination with pathogenic strains of *V. parahaemolyticus*; 2) the spread of antimicrobial resistance (AMR) in *Salmonella* bacteria, a top enteric pathogen in the US. Bacteria occur as pathogenic and nonpathogenic strains. Genomics identifies distinct genes in 'pathogenicity islands'. These approaches can pinpoint pathogenicity islands, leading to precision methods to differentiate strains. NHAES researchers characterized a complex of pathogenic *Vibrio parahaemolyticus* strains, ST36. Vibriosis, associated with oyster harvesting, track ST36. Horizontal transfer of pathogenicity islands or antimicrobial resistance occurs between related or unrelated bacterial strains.

For the critical issue of Food Safety, NHAES researchers will focus on two problems: Improved surveillance for and forecasting of outbreaks of shellfish contamination with pathogenic strains of *V. parahaemolyticus*, led by Professor Cheryl Whistler and Research Associate Professor Steve Jones and Spread of antimicrobial resistance (AMR) in *Salmonella* bacteria, a top enteric pathogen in the United States, directed by Assistant Professor Chery Andam.

Critical Issue Four: CLIMATE CHANGE AND SUSTAINING NATURAL RESOURCES

NHAES

For FFY2020, NHAES research spans: i) Reducing drivers of climate change thru new forages for grazing dairy cows that reduce methane. ii) Adaptation to frequent flooding by shifting from flood avoidance to management via preserving farming bottomland. iii) Precision measurement of ecosystem response to climate stress. iv) Improving the understanding of water quality at river network scales, v) Determining how rivers respond to changing rates of atmospheric nitrogen deposition vi) quantifying oysters filtration of eutrophic estuaries. vii) Refining understanding of bioavailable nitrogen in soils to reduce fertilizing. viii) Exploiting *Frankia*-Actinorhizal plants for bioremediation of contaminated soils and ix) Assessing how necrophilous insects breakdown of carcasses to improves the soil.

Reduce drivers of climate change through new forages for grazing dairy cows that reduce ruminant methane production.
Adaptation to frequent flooding by shifting from flood avoidance to management via preserving farming bottomland.
Precision measurement of ecosystem response to climate stress.
Improving the understanding of water quality at river network scales.
Determining how rivers respond to changing rates of atmospheric nitrogen deposition.
Quantifying oysters filtration of eutrophic estuaries.
Refining understanding of bioavailable nitrogen in soils to reduce fertilizing.
Exploiting *Frankia*-Actinorhizal plants for bioremediation of contaminated soils.
Assessing how necrophilous insects breakdown of carcasses to improves the soil.

UNHCE

Healthy and sustainable lands, waters and wildlife are critical to NH's natural resource-based industry, tourism, recreational activities and the quality of life experienced by our residents. Climate change not only threatens our seacoast communities but will challenge our stormwater management and impact our forestry practices and wildlife stewardship efforts. Working through Areas of Expertise that include Forest and Wildlife Stewardship, Community Natural Resource, Citizen Science, and Fisheries and Aquaculture, our staff provide research-based natural resources information and assistance to private landowners, natural resources professionals, logging and forest products industry, agencies, municipalities, local decision-makers, researchers, schools, volunteers and organizations.

Forest Stewardship provides communities information required to ensure forests contribute to the economy. Programs include selling timber, invasive species management, town & community forest management, woodlot management, conservation training, heating your home with wood, maple production, estate management, prescribed burns, street tree

care, and forest-based industry.

Citizen Science programs engage community members, leaders and local, regional and state-wide partners to build knowledge, skills, and capacity for needs assessment, community engagement, decision-making, and action.

Communities and Natural Resources teamwork to build the capacity of community leaders and volunteers to protect and manage natural resources and strengthen community resilience.

Fisheries and Aquaculture programs provide technical support, permitting requirements, training, and expertise in growth and husbandry of shellfish, seaweeds, and finfish.

Geospatial technologies training includes mobile mapping, LiDAR, crowdsource mapping, transitioning to ArcGIS Pro, and GIS/GPS Bootcamp.

Critical Issue Five: OBESITY AND HEALTH

NHAES

Increasing obesity among Americans tracks increased incidence of chronic diseases such as type II diabetes. One NHAES research Hatch Multistate project will explore the influence of nutrition, institutional policies and environment on weight gain and healthy behavior among young adults. A new NHAES Hatch project, collaborative with UNHCE, investigates the impact of Supplemental Nutritional Assistance Program (SNAP) and SNAP education (SNAP-Ed) on the large NH Bhutanese refugee population. The pilot study will evaluate the impact of SNAP-Ed on dietary choices, safe food handling, insulin resistance and composition of the gut microbiome. The latter will help test the hypothesis that changes in gut microbiome composition are associated with increased risk for insulin resistance.

Planned NHAES research for obesity and health targets obesity as a driver of chronic disease such as type II diabetes. One Hatch Multistate project, NC1193, will explore the influence of nutrition, institutional policies, and environment on weight gain and healthy behavior among young adults. A new NHAES Hatch project, collaborative with UNHCE, investigates the impact of Supplemental Nutritional Assistance Program (SNAP) and SNAP education (SNAP-Ed) on the large NH Bhutanese refugee population. The pilot study will evaluate the impact of SNAP-Ed on dietary choices, safe food handling, insulin resistance, and composition of the gut microbiome. The latter will help test the hypothesis that changes in gut microbiome composition are associated with increased risk for insulin resistance.

UNHCE

The health of New Hampshire's citizens has profound long-term implications for the state's economy and the population's well-being. Poor understanding of nutrition, inactive lifestyles, and systems-level food access issues have led to chronic public health problems such as obesity and diabetes. These issues, when not prevented and/or when untreated, result in significantly higher health care costs, loss of workforce productivity and reduced quality of life. Data from the CDC, the State of NH, and the Carsey Institute suggests that important behaviors such as physical activity and fruit and vegetable consumption are below recommended levels, particularly for lower-income youth and families. Furthermore, because New Hampshire is one of the oldest and fastest aging states in the country, the natural vulnerability and declining health of an older population will exacerbate this critical issue.

Healthy Living programs include Nutrition Connections and SNAP-ED. Our model places an emphasis on food and nutrition efforts that focus on the Dietary Guidelines and MyPlate, specifically, increasing fruits and vegetables and increasing physical activity. The model also places an emphasis on opportunities to reach larger numbers of people through community and volunteer efforts.

Critical Issue Six: YOUTH AND FAMILY

New Hampshire youth are in critical need of positive youth development experiences where they both feel a sense of belonging and are engaged in extended and meaningful ways. Feedback from recent focus groups and key stakeholder interviews, data from National Academy of Sciences, National Institute of Mental Health, and the Youth Risk Behavior Survey, and research by the UNH Institute on Disability and the Carsey Institute all suggest that multiple problems make up this critical issue. They include: increased needs for a workforce that is sufficiently and equitably prepared with both leadership skills and STEM content knowledge, youth who do not feel valued by their communities, rising suicide rates across the state, elevated drug misuse and overdoses by young adults, and increased levels of mental illnesses in teens such as anxiety and depression.

UNHCE

Youth and Family Resiliency programs address the needs of vulnerable audiences. Programs include social, emotional and mindful learning, 4-H military youth and family and youth mental health and wellness. Science Literacy including volunteer education programs such as the UNH Marine Docent and UNH STEM Docent program can introduce science to adults and students in an engaging context and authentic manner. Additional programs include Schoolyard SITES, Seacoast Perch, STEM Discovery Lab and Teaching Through Inquiry and Science Practices. 4-H Youth Development programs aim to develop self-confidence, soft skills (public speaking, writing) in youth. Programs include 4-H Healthy Living, animal science, teen leadership councils (county and state), civic responsibility, shooting sports, horticulture, military youth and families, Barry Conservation Camp, and the work of the 4-H Foundation.

2. FTE Estimates

Year	1862 Extension	1862 Research
2020	75.0	22.0
2021	75.0	22.0
2022	75.0	22.0
2023	75.0	22.0
2024	75.0	22.0

II. Merit / Peer Review Process

Merit/Peer Review of NHAES research funding.

There is an annual call for NHAES research proposals and funding for graduate research assistants or postdoctoral researcher. Potential project directors are encouraged to submit a summary assessed by the faculty fellow for fits funding priorities (<https://www.colsa.unh.edu/nhaes/sites/colsa.unh.edu.nhaes/files/media/nhaesmanual.pdf>). Proposal writers are asked to search the Current Research Information System (CRIS) to identify related research SAES. Full proposals are due in mid-October. An internal panel of UNH NHAES of tenured, research and extension faculty review proposals. Ad hoc internal (UNH) reviews contribute to disciplinary expertise where necessary. The review panel meets to discuss each proposal for several criteria: i.) scientific and technical merit; ii) soundness of approach and methodology; iii) likelihood of significant contributions and/or innovative advances; v) previous and current research productivity and accomplishments (or potential, for new investigators). vi) likelihood of significant enhancement in project directors research capability and competitiveness. The NHAES director and faculty fellow consider panel discussion prior to the recommendation of proposals for NIFA final evaluation.

Qualitative overview of the internal NHAES merit review process comes via the scholarly peer review process, which evaluates the manuscripts originating from NHAES research projects and the ability of project directors to leverage

NHAES funding to compete for external funding.

As appropriate UNHCE coordinates with the NHAES, outreach, training of undergraduates and graduate students, and incorporation into University courses.

III. Stakeholder Input

1. Actions to Seek

NHAES encourages input from stakeholders by multiple means and from various target groups. The NHAES External Advisory Committee consisting of NH farm, ornamental horticulture, and forestry producers and allied industries. The Advisory group meet formally once-twice a year to provide direct input. The Director and faculty fellow interact with individual members of the External Advisory Committee throughout the year.

NHAES researchers interact with both stakeholders traditional and nontraditional stakeholders at meetings (i.e. NH Farm and Forest Expo); with stakeholders groups (i.e. Piscataqua Region Estuaries Partnership (PREP); New England Fruit and Berries Association); and at twilight meetings at horticultural/agronomy farms (offered jointly with cooperative extension), research field days at the dairies and greenhouse facilities, at various facility open houses, at Durham farm day and Fairchild Dairy Open Barn Day.

The NHAES Communication manager has developed a dynamic dissemination program via weekly postings distributed via Constant Comment or YouTube videos. These press releases are often republished by the NH Weekly Market Bulletin, local newspapers, the Associated Press and National outlets such as Ag is America. These often lead to researcher interviews on regional radio programs and TV news will interview researchers. These communications help stakeholders be aware of the distinct roles of NHAES in contrast to UNHCE and generate public interest and queries.

UNHCE engages county advisory councils, comprised of program users, decision makers, and community leaders to annually review updates to programs and plans of work. These councils meet with staff and Extension administration between six and ten months per year. Furthermore, a State Extension Advisory Council meets two or three times per year to discuss new programming initiatives and make recommendations to the Dean and Director of UNHCE. Stakeholders and state and federal partners are engaged with UNHCE professionals on a regular and on-going basis. They contribute to needs assessment, program development, program implementation and program evaluation.

2. Methods to Identify

NHAES identifies stakeholders groups through interaction with UNHCE, NH Department of Agriculture, Markets and Food, NH Department of Environmental Services, the NH Farm Bureau, New England Farm Union. and Northeast Organic Farming Association, as well as various trade organizations and community groups across the state and region. Special efforts are made to solicit feedback from members of the NH state legislature's Environment and Agriculture committee, as well as the New Hampshire's congressional delegation.

UNHCE employs several methods to identify individuals and groups with whom to work. Methods vary according to the program focus. Specialists interact with clients, potential clients, stakeholders and partners through participation in meetings of several agricultural associations and the NH Department of Agriculture, natural resources groups focused on conservation or the nature-based economy, coalitions focused on well-being and health, economic development councils, issue-based advisory committees, youth associations and many more.

3. Methods to Collect

For NHAES strategic planning and setting priorities, input is collected through discussion with stakeholder groups and individuals, including growers, farmers, citizens, agricultural organizations and councils, natural resources professionals and managers, state and federal agency representatives, neighboring state AES and extension administrators.

NHAES methods to collect stakeholder input for individual research projects include:

- Conduct focus groups
- Surveys of target audiences
- Direct interaction with potential end-users

The UNHCE program plan of work addresses high priority needs in New Hampshire identified through on-going counsel

with local and state-wide advisory councils. In addition, advisory council members, county and state staff, faculty and other stakeholders take part in ongoing specific program reviews. Results of program reviews and input from stakeholder groups determine priorities. These program reviews include focus groups, web-based stakeholder surveys and staff surveys as well.

4. How Considered

Stakeholder input is used to continually review and update research priorities, relevant existing and emerging topics, and individual and programmatic performance. This information informs those activities that include faculty and staff hires as well as investments to our facilities and programs. Our strategies, activities, and priorities are dynamic and evolve with consideration of stakeholder input, institutional, and societal goals and funding, and additional factors. NHAES and UNHCE are continually working to facilitate constituent input, focus available resources on priority issues, and improve our delivery of research findings to end users.

Formal and informal stakeholder input to Project Directors, Extension Specialists, staff and administrators is very helpful in gauging the changing needs, constraints, and opportunities that we might address. These influence the specific activities of supported researchers as well as NHAES and UNHCE activities and goals, in the short and long term.

Stakeholder input is used to identify the arising problems and those topics that NHAES researchers have appropriate expertise to make effective contributions. Gaps in research expertise become a factor in prioritizing open faculty positions. However, faculty salaries are primarily covered by student tuition, so identifying individuals who can contribute to robust academic programs, at the undergraduate and graduate levels must be balanced with desired research expertise.

UNHCE is continually working to facilitate constituent input, focus available resources on priority issues, and improve our delivery of research findings to end users. Stakeholder is sought in the budget process, to identify emerging issues, to develop new Extension programs, in the staff hiring process and to set organizational priorities.

IV. Critical Issues

1 Rural Community and Economic Development

Description:

UNHCE

Community & Economic Development program seeks to cultivate civic leaders; foster participation in community decision-making, and build the capacity of communities to grow the local and regional economy. To achieve the mission, Extension Community and Economic Development staff provide civic leaders with training, educational resources, and technical assistance in community engagement, economic development, leadership development, and community-based natural resources stewardship.

NHAES

New Hampshire's rural communities continue to evolve and contribute in different ways to the state's economic success and societal welfare. Local food systems (from production to consumption), tourism, and natural resource management have been continue to be critical to maintaining the vibrancy of rural communities in the state. However, with changing demographic and socioeconomic characteristics in rural communities; consolidation of the food processing sector; changes in local, state, and federal policies; and the structural changes prompted by the COVID-19 pandemic have created challenges to rural communities maintaining economic resilience. Using science-based, data-driven methods to identify key factors stressing economic and social welfare in rural communities and providing research-informed recommendations at the individual, firm, municipality, and state levels are crucial for short- and long-term community sustainability. NHAES researchers will work directly and with UNHCE to engage with relevant stakeholders and communicate their information effectively.

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances
Environmental Systems
Family & Consumer Sciences
Sustainable Agricultural Production Systems

2 Agriculture

Description:

NHAES

NHAES undertakes research toward generating knowledge and technology to support the state's highly diversified agricultural and food system that produces, processes and delivers food, fiber, and myriad environmental services for our citizens. We do this in the context of protecting environmental quality and helping to maintain the resilience and vitality of rural communities. Both basic and applied research are supported to ensure that we address shorter and longer-term needs. NHAES researchers will work directly and with UNHCE to engage with relevant stakeholders and communicate their information effectively.

UNHCE

UNHCE's Food and Agriculture specialists deliver education and technical assistance to residents of New Hampshire, the state's agricultural and horticultural industries, and the state's food system. Specialists are trusted partners, providing current, research-based educational programming to farmers, gardeners, and businesses. UNHCE enables individuals to make informed decisions in the pursuit of sustainable and productive local agriculture.

Term: Long

Science Emphasis Areas

Agroclimate Science
Education and Multicultural Alliances
Human Nutrition
Sustainable Agricultural Production Systems

3 Food Safety

Description:

NHAES

Ensuring a safe food supply is critical to maintaining a healthy population and trust in New Hampshire's food producers. With New Hampshire and the region having a robust local food economy, identifying factors that can increase the risk of food safety issues and determining methods that can prevent and mitigate adverse health outcomes is critical. Research will provide insights and recommendations for crop, aquaculture, and animal and animal product producers about safely growing and storing products; for food processors; for direct-to-consumer marketers; and for food consumers. The research ranges from basic, which will identify genetic components to food safety, to highly applied. NHAES researchers will work directly and with UNHCE to engage with relevant stakeholders and communicate their information effectively.

UNHCE

The CDC estimates that each year about 1 out of 6 Americans or 47.8 million people get sick from foodborne illness. About 128,000 of them are hospitalized and 3,037 die. According to the 2010 publication of Georgetown University, the annual cost of foodborne illnesses is \$152 billion. For New Hampshire, the estimated annual cost of foodborne illness was \$681 million with a per-case cost estimate of \$1,892. Restaurants are projected to record \$2.3 billion in sales between 2012 and 2022. However, more than 63,800 people and many employees have no or limited training in food safety. The UNHCE Food Safety program addresses these needs with food

safety education targeting each sector of the food system, including production, foodservice, and consumers, with research-based educational programs, resources, and information

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances
Environmental Systems
Food Safety

4 Climate change and sustaining natural resources

Description:

UNHCE

Healthy and sustainable lands, waters, and wildlife are critical to NH's natural resource-based industry, tourism, recreational activities, and the quality of life experienced by our residents. Climate change not only threatens our seacoast communities but will challenge our stormwater management and impact our forestry practices and wildlife stewardship efforts. Working through Areas of Expertise that include Forest and Wildlife Stewardship, Community Natural Resource, Citizen Science, and Fisheries and Aquaculture, our staff provide research-based natural resources information and assistance to private landowners, natural resources professionals, logging and forest products industry, agencies, municipalities, local decision-makers, researchers, schools, volunteers, and organizations.

NHAES

Big problems require targeted, multi-disciplinary solutions. Advancing resilient agricultural, food, and natural resources must be balanced with addressing challenges posed by a changing climate. This balancing requires informed, strategic management and stewardship of resources, including land, water, forests, wildlife, domesticated crops and animals, social equity, community sustainability, among many others. Research within NHAES helps identify key factors contributing to climate change, quantify those impacts, and provide data-informed insights about strategic management of natural resources to ensure long-term economically, socially, and environmentally sustainable stewardship of natural resources. NHAES researchers will work directly and with UNHCE to engage with relevant stakeholders and communicate their information effectively.

Term: Long

Science Emphasis Areas

Agroclimate Science
Environmental Systems

5 Nutrition, Health and Wellness

Description:

UNHCE

The health of New Hampshire's citizens has profound long-term implications for the state's economy and the population's well-being. Poor understanding of nutrition, inactive lifestyles, and systems-level food access issues have led to chronic public health problems such as obesity and diabetes. These issues, when not prevented and/or when untreated, result in significantly higher health care costs, loss of workforce productivity, and reduced quality of life. Data from the CDC, the State of New Hampshire, and the Carsey Institute suggests that important behaviors such as physical activity and fruit and vegetable consumption are below recommended levels, particularly for lower-income youth and families. Furthermore, because NH is one of the oldest and fastest aging states in the country, the natural vulnerability and declining health of an older population will exacerbate this critical issue.

NHAES

Increasing obesity among Americans is associated with increased incidences of chronic diseases and greater health uncertainties for emerging diseases such as COVID-19. Understanding the trends in nutrition and health behaviors across diverse NH populations and identifying factors contributing to healthier lifestyles is critical to ensuring long-term well-being of the state's citizens. Research focusing on demographic changes, eating behaviors, consumption of local foods, effectiveness of state and federal policies, among other factors, will provide science-based insights and recommendations for ensuring a healthier workforce, cost-effective stewardship of public program funds, reduced stress on the state's healthcare system, and economic sustainability for individuals and communities. NHAES researchers will work directly and with UNHCE to engage with relevant stakeholders and communicate their information effectively.

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances
Family & Consumer Sciences
Human Nutrition
Youth Development

6 Youth and Family Development

Description:

UNHCE

New Hampshire youth are in critical need of positive youth development experiences where they both feel a sense of belonging and are engaged in extended and meaningful ways. Feedback from recent focus groups and key stakeholder interviews, data from National Academy of Sciences, National Institute of Mental Health, and the Youth Risk Behavior Survey, and research by the UNH Institute on Disability and the Carsey Institute all suggest that multiple problems make up this critical issue. They include: increased needs for a workforce that is sufficiently and equitably prepared with both leadership skills and STEM content knowledge, youth who do not feel valued by their communities, rising suicide rates across the state, elevated drug misuse and overdoses by young adults, and increased levels of mental illnesses in teens such as anxiety and depression.

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances
Family & Consumer Sciences
Human Nutrition
Youth Development